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by DE BRUYKER,[21] in which it is shown that the means and quartiles, and indeed all the ordinates, of the ogive, when calculated according to the methods of GALTON, are a half-unit too low, due to the fact that GALTON constructs his curve on the extremity of the classes instead of on their mid-values. The suggested correction brings a very close agreement between the median and the arithmetical mean. DARBISHIRE[22] gives an interesting popular discussion of correlation of the kind dealt with by biometers, using as his basis the dice-throwing experiment of WELDON, in which the relation between two successive throws of dice are the correlated quantities considered, when a certain number of dice from the first throw are left on the table to influence the result of the second. When none of the dice are left, the two throws are totally unrelated and the correlation is zero; and when all are left, so that the second entry is an exact repetition of the first, correlation is complete. Tables are given showing the actual results of throwing 12 dice in this way under every possible condition as to the number of dice left back to influence the second throw, thus beautifully illustrating the different degrees of correlation between zero and unity.—GEORGE H. SHULL.

Symbiosis.—A recent paper by KEEBLE of Reading and GAMBLE of Manchester, England, continues the investigations of these two naturalists into the subject of the symbiosis of plants and animals.[23] Of late years these two men have been almost the only ones continuing this study, which, as the literature shows, was being actively pursued fifteen or more years ago.

Convoluta roskoffensis is a simple flat-worm living between the tide-marks on the northern coasts of Europe. It is usually green, owing to the presence in its tissue of chlorophyll-containing cells, which have been diagnosed as one of the Chlamydomonadeae. They resemble the members of the genus Carteria, but for certain reason KEEBLE, the botanical collaborator, hesitates to place them positively in this genus. The life-history of both components of the association has been worked out. From this study it is clear that the flat-worm begins its existence free from green cells. There is no transmission of green cells or even of rudimentary chromatophores (plastids) from parent to egg. The green cells appear to be chemotactically attracted to the eggs and egg-cases. Pure cultures of the alga may often be obtained from egg-cases which have attracted and become partly filled with the green motile cells. By carefully washing in sea-water free from the alga, colorless Convolutas can also be obtained. These will remain colorless or will turn green according to subsequent treatment. If kept in sea-water passed through a Pasteur-Chamberland filter, they will remain colorless; if kept in such filtered water to which a loopful of a pure culture of the alga has been added, they will turn green as completely as if they were kept in unfiltered sea-water. Apparently the young animals cannot be infected by cells removed from the bodies of older green Convolutas.

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[21] DE BRUYKER, C., Bemerkingen aangaande de Galton'sche curve. Handel. 10de Vlaamsch Nat. u. Gen. Cong., S. 1906. pp. 6. *figs. 2.*

[22] DARBISHIRE, A. D., Some tables for for illustrating statistical correlation. Mem. and Proc. Manchester Lit. and Phil. Soc. **51**:no. 16. pp. 21. diagrams 12. *1 dbl. pl.* 28 Je 1907.

[23] KEEBLE AND GAMBLE, The origin and nature of the green cells of *Convoluta roskoffensis*. Quart. Jour. Micros. Sci. **51**:167–219. *pls. 13, 14.* 1907.

The green cells are reported to undergo degeneration in the tissues of the animal, especially as regards their nuclei, and to this is attributed the inability of the green cells to maintain an independent existence, or to thrive in cultures, or to infect young Convolutas, when removed from the bodies of older green ones. Whether under suitable conditions of culture, the algal cells may be able to complete themselves, to restore or to regenerate the deficient nucleus, to become rejuvenated, is not determined by these experiments.

The functions of the alga in the body of its host have been experimentally studied. The authors conclude that the alga, photosynthesizing sugar, is osmotically relieved of a considerable portion of this food. It must diffuse, if it remain unchanged, to adjacent cells containing less; but if the sugar be converted into starch,the animal cannot digest and absorb it so long as the algal cells themselves live. Soon after infection with the alga, the animal ceases to excrete its nitrogenous wastes, and these, absorbed by the alga, are converted by it into higher organic compounds, into nitrogenous foods. As many of these as are soluble also diffuse into adjacent animal cells. At this stage it would appear that both animal and plant profit by their association, the animal gaining a supply of sugar and of soluble nitrogenous food, the plant obtaining a steady supply of partly elaborated organic nitrogenous food-material. Later on, however, the animal ceases to ingest solid food, and there being no other source of nitrogenous food than the algal cells themselves, the animal proceeds to devour them in its own tissue. Thus it destroys its source of food and ultimately itself, but before this it breeds.

This association, therefore, is similar to that of fungus and alga in lichens, where the fungus component, incapable of photosynthesis, is forced to obtain non-nitrogenous food, saprophytically or parasitically. The excreta of the dependent component may manure the green plants, but if they do, the benefit is a dubious one, since it leads to destruction without issue.

A word may well be added to commend the ingenuity of the experiments, the care and thoroughness with which they seem to have been carried out, and the caution with which inferences have been drawn from them and stated.—G. J. PEIRCE.

Plant diseases.—A root disease of sugar cane, first described from Java in 1895 by WAKKER is the subject of a bulletin by FULTON.[24] It is characterized by canes of reduced size and weight, and by reduced leaf system. A large percentage of

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[24] FULTON, H. R., The root disease of sugar cane. Bull. 100, La. Agric. Exp. Sta. Jan. 1908.